DOCUMENT RESUME

ED 430 151 CE 078 699

AUTHOR Lenaghan, D.
TITLE Brave New World: A Good News Scenario for Educational Reform.
PUB DATE 1999-00-00
NOTE 39p.
PUB TYPE Reports - Descriptive (141)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Style; Computer Uses in Education; Educational Change; *Educational Needs; *Educational Technology; *Educational Trends; Elementary Secondary Education; *Futures (of Society); Models; Teaching Methods

ABSTRACT

A good news scenario about the future of education in the United States includes many things that are already being done and other things that can be dreamed of. One example is the "Awesome All-Stars Academy," a dream of a group of dedicated politicians, administrators, teachers, parents, community members, and students who took seriously their commission to produce and be educated citizens. The "Awesome" program was based on research in four fields: the changing work force, brain operations and intelligences, diversity among learners, and technological tools for instruction. "Awesome Academy" offers a learning environment that understands and practices teaching for learning. It includes the latest technologies for learning, features teachers who are master motivators and guides, and has a curriculum based on future work force needs and new understandings of the way students learn. "Awesome Academy" is the dream for the future of U.S. education. (Contains 41 references, 20 tables, and 4 illustrations.) (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 430 151

A Good News Scenario for Educational Reform

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
D Lenaghan
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

© 1999 D. Lenaghan

CE 078699

BEST COPY AVAILABLE

TABLE OF CONTENTS

Introduction

Trends Influencing the New Paradigm

- Workforce Kaleidoscopes
- Brain Boosters
- Learner Landscapes
- Technology Tools

Good News Scenario: Awesome All-Stars Academy

Assumptions That Made The Dream A Reality

- Teaching for Learning
- Brain Based Learning
  - Multiple Intelligences
  - Types of Thinking
    - Critical
    - Creative
    - Bloom's Levels

- Learning with Technology
  - Neural Networks Nuances
  - Strengths and Concerns about Learning with Technology
  - Ideas for Integrating Learning and Technology
    - Brain Based Learning with Technology
    - Multiple Intelligences and Internet
    - Thinking and Technology Tools
    - Critical Thinking Technological Tools
    - Creative Thinking Technological Tools
    - Bloom's Levels Technological Tools
  - Instructional Design Schema

Conclusion

Epilogue - Confessions of a Reformed Educator

References

Powerpoint Segments

List of Tables

Table 1 Brain and Learning

Table 2 Multiple Intelligences

Table 3 Critical Thinking Characteristics

Table 4 Critical Thinking Steps

Table 5 Creative Thinking

Table 6 Bloom's Taxonomy

Table 7 Strengths of Learning with Technology

Table 8 Concerns about Learning with Technology

Table 9 Why use Technology

Table 10 Brain and Learning with Technology

Table 11 Multiple Intelligences and Internet Opportunities

Table 12 Critical Thinking Characteristics and Technology

Table 13 Critical Thinking Steps and Technology

Table 14 Creative Thinking Germinal Phase and Technology

Table 15 Creative Thinking Practical Phase and Technology

Table 16 Bloom's Taxonomy and Technologically Assisted Learning

Table 17 Multigogy's Foundational Values

Table 18 Traditional Education Planning Considerations

Table 19 Multigogy's Planning Considerations

Table 20 Teaching for Learning Strategies in Multigogy

List of Illustrations

Illustration 1 Societal Trends

Illustration 2 Guiding Principles

Illustration 3 Computer Networks

Illustration 4 Neural Networks

INTRODUCTION

Recently, I urged a world class futurist to "quit dragging American Education through the mud and publish a Good News Scenario about the Future of Education". His response was: "I agree, you do it!"

Taken aback by this response, yet still emotionally charged from the negative press, I thought about a good news scenario. I searched and searched until I found the school, Awesome All-Stars Academy. This paper records its story.

TRENDS INFLUENCING THE NEW PARADIGM

Awesome All-Stars Academy was a dream of a group of dedicated people (politicians, administrators, teachers, parents, community members and students) who took seriously their commission to produce--and be--educated citizens. They began with research about American Society in the 21st Century. They focused the scope of their study on four distinctive, yet complementary, fields. These were: 1) America's changing workforce, 2) current research about brain operations and intelligences, 3) greater diversity among learners, and 4) technological tools for instruction. Their findings, listed in the next section, became assumptions underlying their plan (Illustration 1).

Illustration 1 Societal Trends

Workforce Kaleidoscopes

As the 21st Century changed from a Manufacturing/Industrial Society to an Information/Service Society, job skills for American Workers changed. Now, workers need 4-R's (reading, writing, arithmetic and reasoning--critical and creative), plus a C (computer skills) and a P (people skills).

The communications revolution made knowledge so accessible, specialized, and evolving that no one knows everything nor produce in isolation. Constantly, workers perform in diverse cross-functional teams to produce new products and serve new customers. As opportunities arise, new configurations of employees emerge. Much like the operations of a kaleidoscope, each part (or person) slides into place to make a unique contribution to the whole.

Different educational strategies are needed to prepare people for this new workforce. The pedagogical model of didactic teaching (do as I say -- learn what I tell) worked in the Industrial Era with hierarchical bureaucracies and blueprints for success. For an

Information/Service Era with kaleidoscopic workforces, educators must adjust teaching methods to prepare workers for the unknown, as well as interactively and cO-productively. Students will need critical and creative thinking skills, multiple intelligences insights, and teamwork skills.

Brain Boosters

New insights into multiple intelligences and the structures and operations of the brain profoundly influence what we know about how students learn. For decades, educators operated on the pedagogical model that after age twelve students were formal and abstract thinkers. Students were taught abstract concepts--with review and repetition they would "get it".

New brain research about information reception, interpretation, storage, and retrieval demands a revision of this practice. The brain's foundational structure may be developed by age twelve (normally) but the interconnected neural pathways and emotional part of the brain are not skilled in abstract learning. I'll "get it" (emotional) and "keep it" (memory) parts of the brain are not fully developed. These neural pathways for abstract, relational thinking, and associated memories continue to develop throughout life.

Based on these and other findings about the brain, the educational practice of teaching abstract information (symbolic concepts or information stripped out of context and without emotion) makes learning difficult, sometimes de-motivating and too often boring! The most advanced or highly skilled learner will

succeed in any learning environment (including abstraction), but it is the hardest way to learn because it is inconsistent with brain operations. When learning strategies are consistent with brain operations, learning is more effective and efficient.

Learner Landscapes

More diverse learners, who bring a broad range of experiences and "ways of knowing" into our classrooms, are participating in classes and workshops. Many non-traditional learners do not succeed (initially) when abstract concepts are presented solely through oral-linguistic presentations.

Learning for all students is enhanced through a multimodal sensory rich bombardment of information and practice. When a learner is asked to learn with only one modality, it is difficult, frustrating, and inefficient. It is like playing catch with one hand behind your back and your eyes or ears closed. Teachers who teach one way (expect learners to learn with one sense or intelligence) are puzzled why lessons that worked in the past don't work any more. Diverse learners will require diverse teaching for learning strategies.

Technology Tools

Technology, when used wisely, is one of the most powerful tools to reach the greatest variety of learners. Educational software, plug-in schools, Internet, virtual field trips, computer based instruction, simulations, telementoring, and distance education, etc. are powerful tools for the learning process (Olson, 1996, Pesanelli, 1996, Halal & Leiborthz, 1996). Technologically based learning and instruction are initially attractive (once fear

of the dreaded computer monster is tamed) because it appeals to one or more of the dominant senses and intelligences. The learner actively seeks information and solves problems in virtually realistic environments and the teacher coaches.

Thus, a paradigm power shift occurs with technology based learning. Both the teacher and learner are active. Technology is a powerful tool for learner centered instruction but it will never replace caring and effective teachers. The common link among schools that successfully integrated technology into the curriculum is a shift in the teacher's attitude. The teacher is no longer the absolute source of knowledge, but a designer of learning experiences in which the learners actively seek, use and synthesize knowledge (Dwyer, Ringstaff, and Sandlitz 1994).

GOOD NEWS SCENARIO: AWESOME ALL-STARS ACADEMY

Awesome planners built their school to address these trends. Awesome knew that in order to produce educated citizens and skilled corporate employees, they needed to incorporate the latest knowledge about the brain and learning into their instructional and assessment strategies and create action-oriented, inclusive learning environments receptive and responsive to a variety of learners. It is a student centered and brained based learning environment that utilizes technology as a tool to enhance learning, self-esteem, thinking, and productivity. Their vision follows…

Imagine--Awesome All-Stars Academy, in which learning is F.A.S.T.--friendly, active, solution

oriented and technologically supported. It's a brave new world for everyone involved (students, parents, faculty, administrators and policy makers) and the potential is awesome. Classes access the world with a touch of a button or a screen from a computer learning station or a laptop. It's a whole new word of textbooks in notebooks, e-mail, Internet, instructional games, global pen pals, international teachers, cultural studies and virtual reality.

Imagine no more outdated textbooks and no more excuses about forgotten books and papers. Through e-mail, homework assignments are sent to parents and students. There are active on-line discussions about issues, questions and assignments. Students communicate with classmates about team projects, sports and friends. Parents and teachers talk asynchronously at times mutually convenient.

Imagine--Internet's possibilities and its open wide range of activities from virtual exploration of concepts, vast reservoirs of knowledge, contests in math, science, arts, and asynchronous or synchronous conversations with experts, and--of course--games. The Internet is a huge laboratory to develop, practice, and test critical and creative thinking skills.

Awesome's New World utilizes educational

software for productivity, presentations, tutorials, simulations, drill & practice and gaming. Advanced and homebound students are learning at a distance through two-way interactive telecommunications.

In Awesome, teachers are leaders, motivators, coaches, counselors, role models and surrogate parents. They are expert instructional designers combining a range of instructional methods (cooperative learning, problem solving, drill and practice, simulations, tutorials, discussions, discovery, presentations, demonstrations and instructional games) into dynamic and meaningful learning experiences.

Awesome's students are active researchers, experimenters, analysts, mathematicians, writers, communicators and team members. They are curious and enjoy learning.

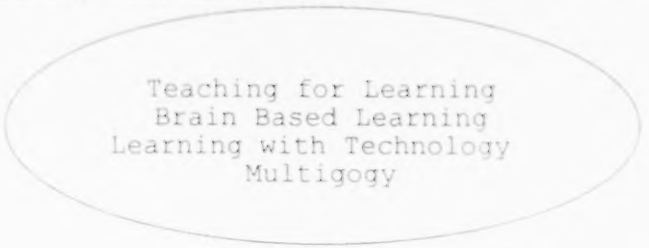
The future and present in Awesome are grand and glorious because students, faculty, administrators, parents and community members are actively participants in the learning process!

ASSUMPTIONS THAT MADE THIS DREAM A REALITY

As a first step, Awesome's planners asked themselves three questions: what is learning, what is teaching and what about

technology? They researched each question and developed principles based on them (Illustration 2).

Illustration 2 Guiding Principles



Teaching For Learning

Teaching for learning was the guiding principle, underlying value that made Awesome's vision a reality. Teaching for learning was more than a catchy slogan. It was a paradigm shift from the past. Now longer were teaching and learning isolated activities but they were integrated components within all strategies. Teaching was the means to the end result of learning not the end by itself. Teaching was the input and learning is the output. It was a subtle difference, but incredibly powerful and profound.

With this paradigm shift, teaching was no longer business as usual. It became business as unusual. When Awesome's students were active learners, teachers shifted from "know-it alls" to "access-it alls" and technology was a major tool used by teachers and learners. Teachers became engineers of learning experiences and skilled in accessing knowledge bases.

Learning was the driving force in Awesome All Stars Academy. Its components were explicit and drove the curriculum, instructional design, and assessment strategies. Awesome's

operational definition of learning was change in knowledge, skills, and attitudes measured by mastery of certain objectives that required development of a student's intellectual capacities. With learning as the focus, Awesome's planners researched the brain's biological processes, intelligence, thinking, and technology. Their summaries for each area are contained in the next section.

Brain Based Learning

In the 1980s researchers, using MRI and CAT scans, began to unravel the mysteries of the structure and functions of the brain. Awesome planners focused on two areas; brain operation and Multiple Intelligences.

Brain mapping (observing and analyzing the neuron firings in human brains) defined the biological paths and processes for learning. Emerging from this research, were five key insights for education (Table 1).

Table 1 Brain and Learning

Brain Based Learning
The emotional part of the brain is a preliminary processor of the brain thus gateway to the learning process.
Neural pathways of previous learning are established through repetition.
Short-term memory storage capacity is limited. Information must be manipulated or applied for transfer from short-term to long-term memory.
New information and experiences shape neural pathways established by prior learning.
Problem based learning requires active neural connections across and between numerous memory and activity centers of the brain.
Brain operates on a ninety-minute energy cycle then needs a break.

(Source: Fuijita-Starck,1996; Hannaford, C. 1993; Sylwester, 1995)

Multiple Intelligences

Awesome's planners endorsed Howard Gardner's, Multiple Intelligences theory, which defined intelligence as "the ability to solve problems or to make something that is valued in one or more cultures" (Checkley, 1977, p.9). According to Gardner, students are smart in at least eight different areas (Table 2).

Table 2 Multiple Intelligences

Type of Intelligence	Ability to create or use…
Linguistic	Language, words and verbal expressions
Logical-Mathematical	Sequential and deductive logic and reason, and mathematical and scientific methods of problem solving
Spatial	Colors, dimensional relationships and holistic and contextual reasoning
Bodily-Kinesthetic	Hands and body movement for expressions, coordinated movement and model building
Musical	Hear recognize, remember, manipulate and create sounds and patterns of music
Intrapersonal	Self understanding, reflection and personal power
Interpersonal	Make connections among other people, influence, understand and produce well with others
Naturalistic	Discriminate among living things and sensitivity to features of nature

(Adapted from: Armstrong, 1994; Checkley, 1997; Gardner, 1993)

Awesome's planners discussed the intelligences' interconnectivity and how the categories should not be used to classify people. Each person has two or three dominant intelligences that he or she uses to complete daily tasks, solve

problems and respond in stressful situations. Awesome wanted to provide multiple opportunities for students to learn and demonstrate their learning through all these intelligences. They agreed to build strategies conducive to the brain's biological paths and Multiple Intelligences.

Types of Thinking Skills

Once Awesome's planners understood how the brain worked, they focused on thinking. They researched critical and creative thinking and levels of thinking.

Critical Thinking

Awesome operationally defined critical thinking as a set of skills to process and generate information and beliefs and habits of using those skills (Scriven, on-line and Elliott, 1966). They found nine characteristics or habits of critical thinkers that were universal regardless of the subject. These habits and steps were summarized in Tables 3 and 4.

Table 3 Critical Thinking Characteristics

Characteristics
Illustrative Thoughts
Accuracy
Consistency
Relevance
Depth including complexities
Breadth including others points of view
Fairness
Detailed precision
Logic

(Adapted from Elder and Paul, on-line)

Table 4 Critical Thinking Steps

STEPS
Distinguish between facts and opinions
Recognize language bias
Research for accuracy
Analyze arguments based on facts
Explore all perspectives before making decisions
Present and defend arguments

(Adapted from Elder and Paul, on-line)

Creative Thinking

Awesome planners agreed that critical and creative thinking were frequently correlated but not dependent on each other. Thus, they needed to agree on a definition and explicit components for each. They accepted Gardner's description of a creative person as "one who regularly solves problems, fashions products, defines new questions in a domain that is considered novel but that ultimately becomes accepted in a particular setting" (1983, p. 35). They agreed that creative thinking included problem solving, initial novelty, and ultimate acceptance by others. Also, they identified eight stages of the creative process (See Table 5).

Once these foundational elements were established, Awesome made two clear distinctions between critical and creative thinking. One was the presence of emotion in creativity and its controlled absence in critical thinking. The second distinction was the type of thinking. Creative thinking requires divergent

thinking (generating a range of acceptable ideas) and critical thinking process requires convergent thinking (one acceptable solution).

Table 5 Creative Thinking

Creative Thinking Germinal Phase
Willingness to try something new
Explore new ideas
Brainstorm without judgement
Evaluate strengths and weaknesses
Rest awhile (incubate ideas)
Creative Thinking Practical Phase
Apply ideas to task
Create something new (problem solve)
Share product with others

(Source: Oech, http://www.ozemail.com.au/~caveman/Creative/Brain/vonoech.htm)

Since Awesome's planners were both creative and critical thinkers, they knew that they should address one more aspect of thinking. This was outcome (or mastery level) for student achievement. For this, they turned to Bloom.

Blooms Levels of Thinking

Awesome planners chose Bloom's Taxonomy as their framework for concept mastery. Generations of teachers have used Bloom's Taxonomy to specify learning outcomes. These levels are summarized in (Table 6).

TABLE 6 BLOOM'S TAXONOMY

Name	Description/Translated into Action
Knowledge	Recall of specific facts
Comprehension	Understand facts
Application	Generalize and abstract to concrete situations
Analysis	Breakdown a problem in parts and reveal relationships among and between parts
Synthesis	Combine parts together into a whole; possibly, but not necessarily, creating a novel but plausible whole
Evaluation	Make judgement based upon facts

(Source: Adapted from Elliott, 1966, p. 286)

As a school goal, Awesome wanted all students to achieve his or her highest potential and level of mastery. They believed that different mandated objectives, concepts, curricula and age appropriateness of students should determine the desired level of thinking. Awesome wanted teachers, within the boundaries of state and curriculum mandates, to make the ultimate decision about which level.

Learning with Technology

With explicit assumptions about learning and thinking, Awesome planners turned their attention to technology and its effects on learners and the learning process. They began with the simplest and most obvious level of comparison--comparing a brain and a computer.

Neural Network Nuances

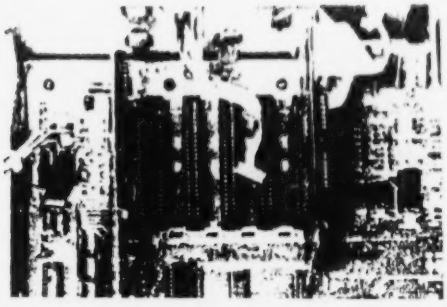
The findings of this comparison intrigued Awesome planners. First in its simplest description, the way information is processed is similar in the brain and a computer. Both the brain and a computer work with electric circuitry (Illustrations 3 & 4).

The types of circuitry of the brain and a computer are very different. The human brain operates off of a parallel circuitry with millions of neural connections at the same time. Currently, most computers are connected with a series circuit. This means that they are connected in series with different signals running through a single circuit-- a single thought and action at a time (Greenfield, 1996). Computers are able to replicate a neural network of a single brain function, but unable to run a series of networks at the same time like the brain.

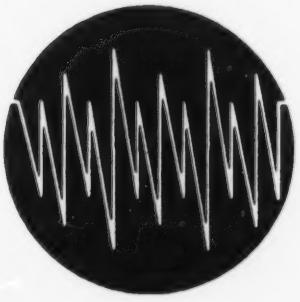
The thinking capabilities of the human brain and a computer also differ. Logical and critical thinking are well duplicated by computers, but not creative. A human brain is capable of critical and creative thinking and is very emotional in its initial functioning. Although the computer can create strong emotions in the user, the computer is emotionless in its processing.

Computers excel in branching into vast areas of knowledge, but--so far--need to be programmed for the analyses and synthesis phases of thinking. Also, computers are not intuitive and spontaneous. The Artificial Intelligences field has not replicated the brain's imaginative process, but it is working on it. Currently, computers are not able to initiate the human brain's innovative, mixed-up, and illogical insights.

Illustration 3 Computer Circuits

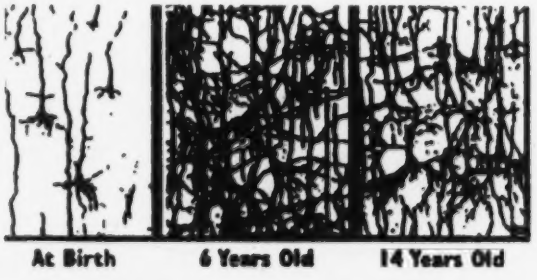


(Source: Roblyer, M. 1997)



(Source: Corel Clipart, 1996)

Illustration 4 Human Brain Circuits



Synaptic Density in the Human Brain

(http://www.iam_yourchild.org/docs)

(Source: 1997. Time Magazine. p.51)

Strengths and Concerns about Learning with Technology

Quickly, based on this simplest comparison, Awesome's planners grasped the complementary potential of technology and wanted to know more about its effectiveness. They consolidated their research into the following points to guide their planning and implementation (Tables 7 and 8).

Table 7 Strengths of Learning with Technology

Strengths
Educational technology had positive effects on attitudes toward learning and self-concept.
Level of effectiveness was dependent on student population, software design, instructional design, structural support and teacher's attitudes.
Lesson plans incorporating software and cognitive strategies were most effective.
Student to student cooperation increased with technology. The concepts and skills of collaborative learning must be taught.
Computers were most effective in the areas of recall and rote memory.
Drill and practice activities were excellent for basic skills.

(Source: Interactive Educational Systems, 1998 & Trotter, 1999)

Table 8 Concerns about Learning with Technology

Concerns
Lack of standardized tests to measure creativity may underestimate the effectiveness of technology.
Lack of research to understand and prove effectiveness of Constructivist theory of education.
Limitations of linking learning with technology to Constructionism, only. Why can't Essentialists, Behaviorist, Pragmatist or Humanistic teachers use the powerful tools of technology?
Lack of research about computers' effectiveness in developing higher order thinking skills.
Absence of time during computer assisted instruction for reflection, absorption, and processing phases of learning.
Absence of time during computer assisted instruction for incubation periods necessary for creativity.
Appearance of gender inequities in preferences for computer applications. Fewer girls enroll in advanced computer courses and fewer female characters are portrayed in computer programs.
Computers, TV and videos provide a multimodal range of information but knowledge must be processed for understanding, integration and meaningful application.

(Source: Adapted from Interactive Educational Systems, 1998, Trotter, 1999 & Weinman, 1999)

Once again, after reflecting on strengths and concerns, Awesome's planners asked themselves, "Why use computers". Their responses were listed in Table 9.

Table 9 Why Use Technology?

Why Use Technology?
Computer based learning is initially attractive to students because it simultaneously stimulates multiple senses.
It's multi-modal, new, exciting, active and students--not the teacher--seem in charge.
Computers and Internet intrigue the brain's emotional trigger, which is the gateway to learning.
Students who are successful with computer based learning activities have completed incredibly intricate and interrelated neural brain activity.
It is an excellent tool for certain types of learning when used appropriately.
It is complementary with all 10 types of instructional methods.
It is a mandatory job competence for most levels of employment in the 21st Century.
It's fun and exciting for students and teachers.

Convinced that learning with technology was imperative, Awesome planned to monitor and address their concerns with qualitative and quantitative research projects. And they planned strategies for incorporating technology into the learning process. They agreed to intersperse technologically supported learning activities with traditional learning activities.

Ideas for Integrating Learning and Technology

With the decision to widely integrate technology into learning strategies, Awesome's planners' next step was to link their research on learning with technology. They began with Brain Operations.

Brain Based Learning with Technology

Awesome planners took the components of learning gleamed from their research and related these to technological processing components. Their thoughts are recorded in Table 10.

Table 10 Brain and Learning with Technology

Brain Based Learning	Technology Assisted Learning
Affective Learning	It is fun, novel and students feel in control. Most Internet sites require students to hear, see and do the content.
Neural networks reinforced through repetition	Consistent communication protocols reinforce linear thinking process and make it easier to get to the objective.
Concepts learned must be used for transfer from short term to long term memory	Active manipulation of data and/or skills on a site require learners to do something with the information, thus aiding the transfer into long-term memory.
New learning builds on past learning networks	Instructional design and hypertext allow learners to start and review basic concepts and build upon those with additional links.
Problem Based learning requires cross-brain neural activities	Many internet activities are contextual and problem based requiring students to research an issue or manipulate data. This requires brain activity across different brain operations and memory centers.
Ninety minute energy cycle of the brain	Activities and stimuli change so frequently in Internet and software programs that the sensory habituation is less noticeable.

With the linking of brain operations and technology, Awesome's planners were ready to brainstorm technological activities for each of their research areas. Their ideas were not intended as exclusive or exhaustive. Their list was intended to stimulate additional thoughts. Awesome's planner's started by linking each of the Multiple Intellignces with technology.

Multiple Intelligences and Internet

Because of its vastness and current popularity, Awesome planners chose the Internet as the strategic tool to match with type of intelligences (Table 11). Since the intelligences work in conjunction with each other, many of the categories and Internet activities overlap.

Thinking and Technology Tools

After intelligences, Awesome focused on thinking skills. They believed student's critical and creative thinking skills were developed through guided opportunities for self-reflection and collaborative learning. Their findings, Tables 12, 13, 14, and 15, became suggestions for potential learning activities within curricula and lesson plans.

Table 11 Multiple Intelligences and Internet Opportunities

Multiple Intelligences	Internet Opportunities
Linguistic	Newsgroups, List Servers, e-mail, Chat Rooms, access to Libraries through the world, on-line journals, Bulletin Boards and text used in most sites
Logical-Mathematical	Access to current researchers and data bases, information and site data analysis, math and science game sites, scientific gaming simulations, NASA's Quest Program, Global SchoolNet Foundation and sequential problem solving opportunities in most sites
Spatial	Tours of greatest museums around the world, virtual reality sites, video bits, 3-Dimensional representations, Clip art and colorful displays and graphical environments used in most sites
Bodily-Kinesthetic	Olympic coverage, Centers for Health Research and Statistics, NCAA online, Gaming Zone, and haptic and item manipulation skills found in basic keyboarding skills and most games
Musical	Rock & Roll Hall of Fame, Classical Net, House of Blues, Music on the Web, Piano page and musical backgrounds in sites or sound files with various texts
Intrapersonal	Personal Home Pages, on-line portfolios, personal thoughts and reflections expressed in E-mail, listservers and discussion groups
Interpersonal	Telementoring, Youth in Action sites, on-line discussion groups, travelers' guides, virtual tourists, electronic villages, CyberPals, Senior Sites, MicorMuse
Naturalistic	Electronic field trips, Natural Geographic Society for KidsNet, Save the Environment Sites

Table 12 Critical Thinking Characteristics and Technology

Critical Thinking Component	Technology Based Activity
Characteristics	
Illustrative Thoughts	Visual mapping and design programs
Accuracy	Internet and TV information examined for accuracy and conflicting data
Consistency	Use of spreadsheets and tables to track information
Relevance	How recent and credible is the author of sources of information.
Depth including complexities	Hyperlink branching for more knowledge in CAI and Internet
Breadth with others viewpoints	Discussion Boards and Chat Rooms
Fairness	Examine articles and videos for presentations of arguments & opinions
Precision with details	Table and charts to visually organize information for comparison
Logic	Programming logic. Discovery programs

Table 13 Critical Thinking Steps and Technology

Critical Thinking Component	Technology Based Activity
Steps	
Distinguish between fact & opinion	Analyze news and articles for facts
Recognize language bias	Compare and contrast viewpoints. Highlight in different colors bias and emotional language
Research for Accuracy	Check out assumptions with facts, search multiple sources
Analyze arguments based on facts	"Reading for Critical Thinking", "Science Court", "Thinking Things"
Explore all perspectives before making a decision	Problem solving software and games, integrated science and critical thinking curricula
Present and defend arguments	Videotaping of arguments, bulletin and discussion boards

Table 14 Creative Thinking Germinal Phase and Technology

Creativity Component	Technological Learning Activities
Germinal Phase	
Willingness to try new ideas	Fun and exploratory software, fantasy games
Explore new ideas	Internet, encyclopedias, "CAD" programs
Brainstorm without judgement	"Inspiration", "Semantic Mappers", "Kid's Pics"
Evaluate strengths and weaknesses	"My teacher is an Alien", "Dr. Brain", "Widget Workshop"
Rest awhile (incubate ideas)	Play musical CD or take a virtual field trip

Table 15 Creative Thinking Practical Phase and Technology

Creativity Component	Technological Learning Activities
Practical Phase	
Apply ideas to task	Create story book, "Metacreations", "Print Artist", "SimCity", drawing packages
Create something new or solve a problem	Problem solving software, Hyperstudio, SoundCompanion, Multimedia projects
Share product with others. Create something new	Bulletin Boards, file exchanges, Web publishing, contests and activities

Constantly, in conversations about critical and creative thinking, Awesome planners asked themselves "how well do we want our students to know these concepts?" Thus, they developed suggestions of technology based activities matched with steps in Bloom's Taxonomy (Table 16).

Table 16 Bloom's Taxonomy and Technology Activities

Type of Thinking	Technological Learning Activities Examples
Level 1 = Recall	Drill & practice software, presentation and reference software, electronic spelling test, math drills
Level 2 = Understanding	Tutorial software, integrated learning systems, reading comprehension series, virtual field trips
Level 3 = Application	Problem solving, gaming, thematic software, virtual reality, Sciencelabs
Level 4 = Analysis	Databases, spreadsheets, reading for critical thinking series, "Science Court", "Carmen SanDiego"
Level 5 = Synthesis	Writing across curricula, Humanities software, Web page builders
Level 6 = Evaluation	Computerized testing, electronic portfolios, grade books

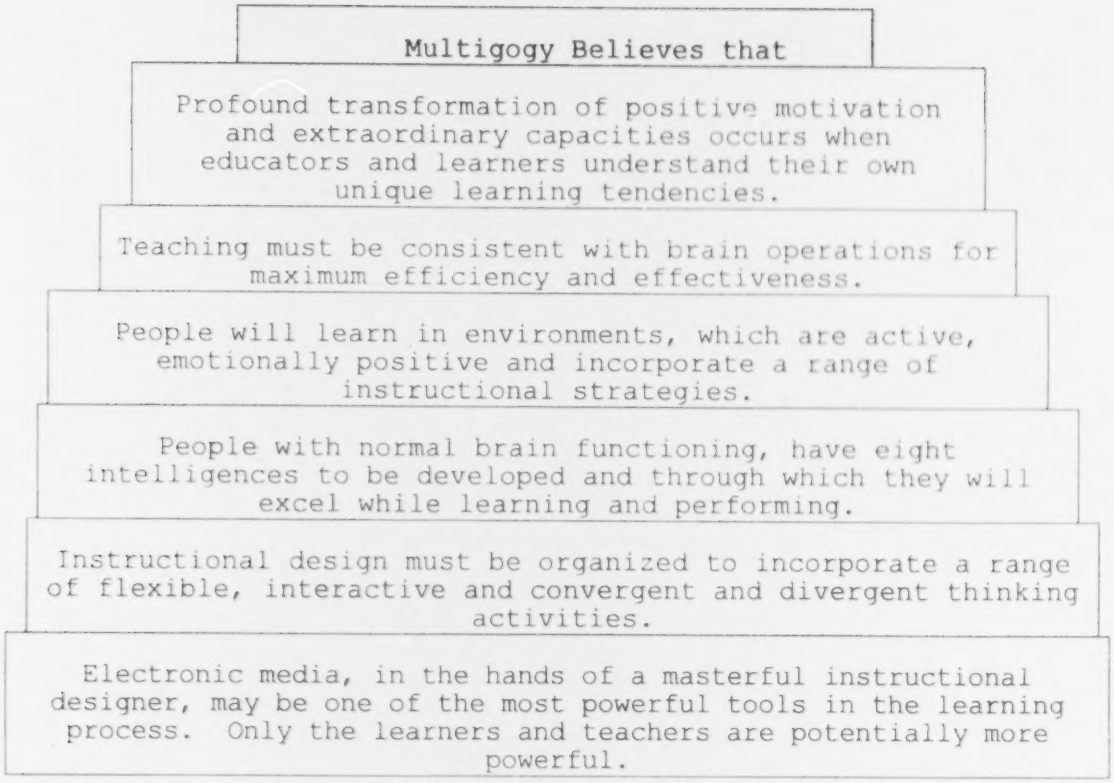
Instructional Design Schema

Awesome completed a lot of research, dreamed, and schemed and created a schema to make their dreams a reality. For this, they used Multigogy.

Multigogy (nicknamed Multi) is a simple overview of the range of considerations to be addressed in learner centered and brain based instructional design. The acronym M.U.L.T.I. (Many Unique Learning Tendencies Impact) is its prefix to which the Greek root "gogy" (which means teaching) is added.

The issues of independent learners (self-directedness), motivation by triggering the emotions, multiple intelligences, memory process, and types of thinking are addressed in Multigogy. The six foundational values in Multigogy are listed in Table 17.

Table 17 Multigogy Foundational Values

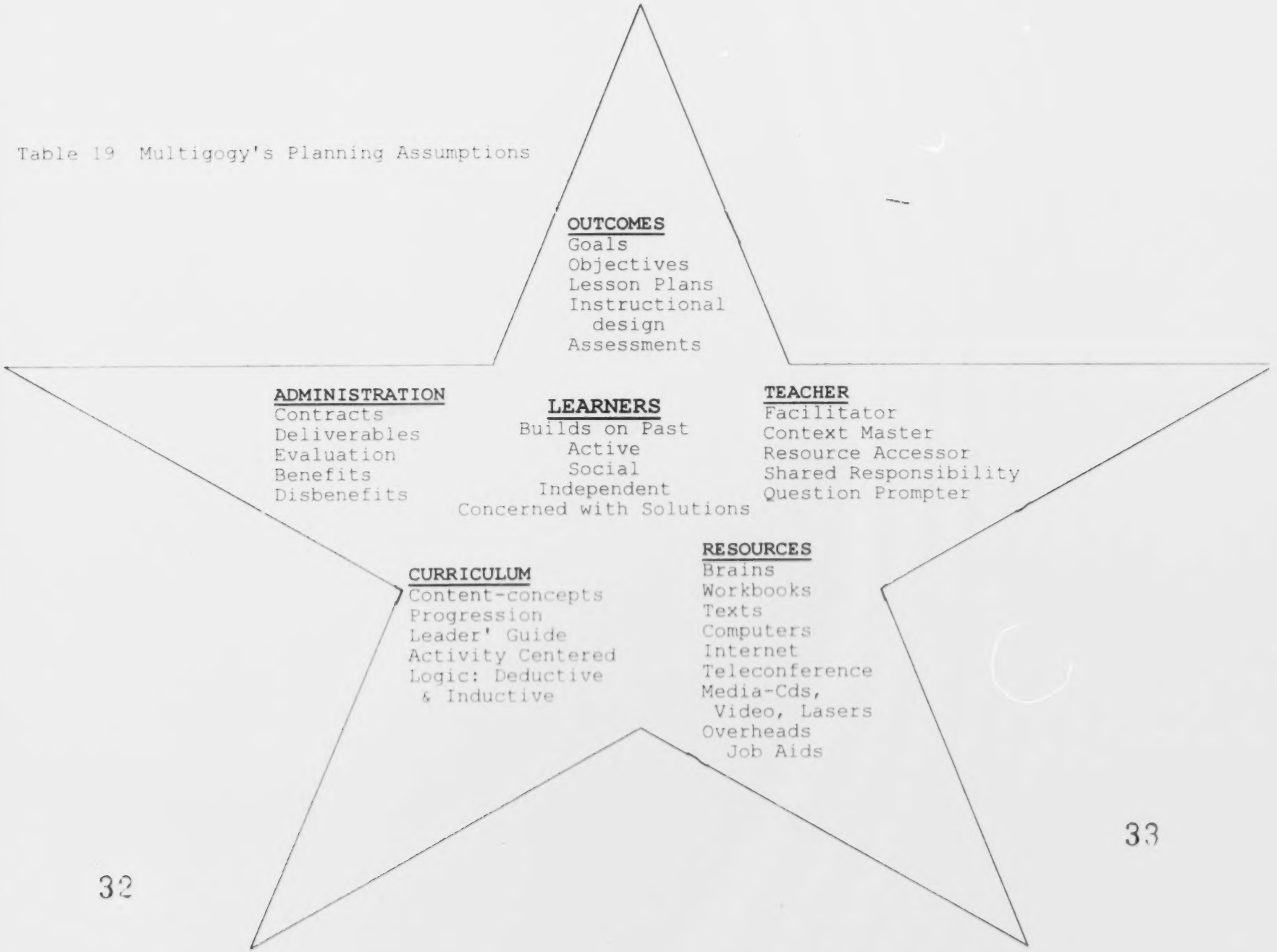

Multigogy Believes that
Profound transformation of positive motivation and extraordinary capacities occurs when educators and learners understand their own unique learning tendencies.
Teaching must be consistent with brain operations for maximum efficiency and effectiveness.
People will learn in environments, which are active, emotionally positive and incorporate a range of instructional strategies.
People with normal brain functioning, have eight intelligences to be developed and through which they will excel while learning and performing.
Instructional design must be organized to incorporate a range of flexible, interactive and convergent and divergent thinking activities.
Electronic media, in the hands of a masterful instructional designer, may be one of the most powerful tools in the learning process. Only the learners and teachers are potentially more powerful.

Multigogy positively engages the learner's affective and preferential sensory modalities for learning--thus motivates the person to learn. With Multigogy, students to feel comfortable. about learning or simply stated it allows unique individuals to teach, learn, and "play with a full deck". Multigogy's constructs are rooted in the educational psychological theories of Cognitivism, Constructivism, and Social learning (Lenaghan, 1998) and qualitative case studies. Tables 18 and 19 illustrate the planning considerations in traditional and Multigogy models for teaching for learning.

Table 18 Traditional Education Planning Considerations

Curriculum
State & District Objectives Standardized Assessments Textbook Lecture Notes Knowledge and Skills Discrete Objectives
Teacher
Lecturers Answer Questions Teacher Dominant Content Expert
Students
Passive Listen Note takers Recall knowledge

Table 19 Multigogy's Planning Assumptions



Awesome chose Multigogy because it was a teaching for learning design that produces all-star learners for the 21st Century workforce. Like the kaleidoscope, different combinations of components create novel arrangements. The focus is teaching for learning and designing lessons so students, outcomes, content, and instructional methodologies slide into place to make a memorable learning experience.

Awesome used Multigogy's sample lesson plans, instructional design format, multiple intelligence lesson planning and assessment forms and teacher training workshops. Table 20 is a summary of the teaching for learning strategies within Multigogy.

Table 20 Teaching for Learning Strategies in Multigogy

Multigogy's Learning Strategies
Positive emotional chargers and rechargers
Cooperative Learning Opportunities
Effective incorporation of technology into learning designs
Independent and reflective learning opportunities
Constructs, concepts and components broken into simple, small and sequential units and rebuild them into holistic unit
Integrated thematic units incorporating technology
Students engaged in problem solving activities, case studies, scenarios, experiential, virtual, and realistic learning environments
Distance education opportunities through videoconferencing for mature learners, homebound students and/or specialized subjects
Effective, efficient, and wise stewardship of technology that is accessible to all learners regardless of abilities, gender, or socioeconomic status

Through their research and within Multigogy, Awesome found the rationale and planning strategies for designing teaching for learning activities with technology. When experienced Awesome educators learned about Multigogy, they exclaimed: "I've been doing it right all along and didn't know it." For them, it was reassurance and a means to evaluate why some lessons are outstanding and some so-so. For the newest team member, it provided a firm launching pad for planning instruction and building upon personal strengths.

CONCLUSION

Awesome All-Stars Academy offers a learning environment that understands and practices teaching for learning. It developed over a five-year period with guiding principles, teaching for learning research, and strategy development and implementation. Awesome was created through widespread leadership and support from district, administrators, parents, community members, computer technicians, and students. They made teaching for learning components explicit so it could be replicated and institutionalized. They felt that the process of teaching for learning was too important to be mysterious. Awesome created a model for others to follow.

Awesome's dream became a reality because their planners were responsible, committed, and effective cross-functional team members who believed in a grand and glorious future. They were committed to in-depth understanding of the teaching for learning process with all its complexities, knowing how to use technology effectively and efficiently, and how to analyze, plan and/or adjust instructional methodologies and learning climates.

EPILOGUE

Therefore, my response to the Futurist who wanted a Good News Scenario--Look to Awesome All-Stars Academy. Yes, there is a grand and glorious future for American education and there are numerous success stories like Awesome. Each success includes teaching for learning, brain based learning strategies, wise utilization of technology, and a framework for instructional design.

In each of these schools and classrooms, there are dedicated professionals who are renaissance teachers. Sometimes they are young fresh teachers and sometimes they are veteran teachers who changed. One of Awesome's veteran teachers recorded his story in the following "Confessions of a Reformed Educator".

"Confessions of a Reformed Educator"

It is so massive and so hard!
The teacher thought it wasn't worth his time to waste so much time on that computer line.
when there was so much to be learned and so little time!
He didn't even ask to have one in his class.

But one day when his workload was slow, he visited a class.
He saw active and excited learners on technology tasks.
*And they were having **fun**!*
These students were focused and the pace of learning was oh-so FAST.
They wanted to continue way past their time to be done.

WOW - he thought to himself--what a difference this teaching tool makes.
It transforms the learning environment and keeps the students

awake!
Yet, he pondered, I know it is a limited tool -- what is it that makes this learning so cool?

He paused and you could see the flash of insight on his face.
"Why it's me and other masterful teachers who design activities for techy tools.

We are the ones who connect the electricity in student's minds.
And we do it through a Masterful learning design!
Yes, it is the teacher who designs activities to come alive on those computer lines.

The students who learn and others who observe never completely understand the brilliance of this invisible design.
And the change that's transformed through the Touch of the Teacher's masterful instructional design.

(Adapted from Welch, M. (1995). Touch of the master's hand. Boston: Abbey Press.)

Yes, there is a grand and glorious future for American Education. And everyday heroes and heroines, like those in Awesome, are making these dreams a reality!

The End.

'Author's Note: Frequently, I'm asked: "Where is Awesome? I want to visit it." MY response is: "It's everywhere, but most importantly it is in your heart, mind, and hands!"

© 1999 D. Lenaghan

REFERENCES

A brief history of critical thinking. [On-line]. Available: http://www.sonoma.edu/cthink/University/univlibrary/cthistory.nclk.

American heritage dictionary. (1976), Boston: Houghton Mifflin Company.

Bennis, W. (1997). Organizing Genius. Reading, MA: Addison-Wesley.

Barrett, S. (1992). It's all in your head. Minneapolis, Minn: Free Spirit Publishing.

Can computers help you think? [On-line]. Available: http://www.ozemail.com.au/~caveman/Creative/Software/essay.htm

Cougar, J. (1996). Creativity and innovation. Boston: Boyd & Fraser Publishing Company.

Creative thinking-what is it and Can it be Taught. [On-line]. Available: http://www.cdtl.nus.edu.sg/publications/snote/taught.htm

Cross, D.P. (1981). Adults as Learners. San Francisco:Jossey-Bass.

Definitions of creativity. [On-line]. Available: http://www.ozemail.com.au/~caveman/Creative/Basics/definitions.htm

Deejski. "Connective transactions - technology and thinking Skills for the 21st Century. [On-line]. Available: http://www.adprima.com/ disc6/0000005a.htm

Dewey, J. (1938). Democracy and Education. New York: MacMillian.

Dwyer, D., Ringstaff, C. and Sandholts, J. (1994). Changes in Teachers' Beliefs and Practices in Technology-Rich Classrooms. In Asen, S. (ed.), Teaching and learning with technology facilitator's guide. Alexandria, VA: Association for Supervision and Curriculum Development.

Elder, L. & Paul, R. Universal intellectual traits. [On-line]. Available: http://www.sonoma.edu/cthink/University/univlibrary/intraits.nclk

Elliot, S., et al. (1996). Educational psychology. (2nd e.) Chicago: Brown & Benchmark Publishers.

Four stages of Creative thinking. [On-line]. Available: http://www.ozemail.com.au/~caveman/Creative/Brain/vonoech.htm

Fuijita-Starck. (1996). "Motivations and characteristics of adult students: Factor Stability and Construct Validity of Educational Participation Scale". Adult Education Quarterly. 47(1). pp.29- 40.

Gardner, Howard. (1993). Creating Minds. New York: BasicBooks.

Gardner, Howard. (1993). Multiple intelligences: the theory in Practice. New York: BasicBooks.

Greenfield, S. (1996). The human Mind Explained. New York: Henry Holt and Company, Inc.

Hannaford, C. (1995). Smart Moves: Why Learning is not all in your head. Arlington, Virginia: Great Ocean Publishers.

Halal, W. and Leibowitz, J.(1996). Telelearning: The Multimedia revolution in Education. In Cornish, E. (Ed.), Exploring

Your future (pp. 95-100). Bethesda, Maryland: World Future Society.

Knapp, L and Glenn, A. (1996). Restructuring schools with technology. Boston: Allyn & bacon.

Knowles, M. (1980). The modern practice of adult education. New York: Cambridge, The Adult Education Company.

Interactive Educational Systems Design. Inc. (1998) Report on effectiveness of technology in schools, "95-96". New York: Self-Published.

Lenaghan, D. (1996). "Balancing the See-Saw: A kaleidoscopic paradigm shift of Know-How (21st century education and training priorities)". Resources in Education. July. Columbus, Ohio: ERIC Clearinghouse on Adult, and Career Vocational Education, U.S. Department of Education.

Lenaghan, D. (1998). Theoretical Underpinnings of Multigogy. Miami: Multigogy.

Miller, M. (1997). Brain Styles. New York: Simon & Schuster.

Oech, R. The seven steps according to Roger von Oech. [On-line]. Available: http://www.ozemail.com.au/~caveman/Creative/Brain/vonoech.htm

Olesen, D. 1996). The top 10 technologies for the next 10 years. In Cornish, E. (Ed.), Exploring Your Future (pp. 67-71). Bethesda, Maryland: World Future Society.

Pesanelli, D. (1996) The plug-in school. In Cornish, E. (Ed.), Exploring your future (pp. 157-160). Bethesda, Maryland: World Future Society.

Peters, R. (1975). Education and reason. London: International Library of Philosophy of Education.

Roblyer, M. et al. (1997). Integrating educational technology into teaching. New Jersey: Prentice-Hall.

Scriven, M. Defining critical thinking. [On-line]. Available: http://www.sonoma.edu/cthink/University/univclass/Defining.nclk

Special Report-Child's Brain. (1997). Time Magazine, February 3, p.51.

Sternberg, R. (1996). Successful intelligence. New York: Simon & Schuster.

Sylwester, R. (1995). Celebration of neurons. Alexandria: ASCD.

Trotter, A. A question of effectiveness. Milken Exchange. [Magazine, on-line] Retrieved January 20, 1999: http://www.edweek.org/sreports/tc98/intro/in-n.htm.

Universal intellectual standards. [On-line]. Available: http://www.sonoma.edu/cthink/University/univlibrary/unistan.nclk

Van der Meer, R. & Dudink, A. (1996). The brain pack. St. Helier, Jersey, Channel Islands: Singram Company, Ltd.

Wallis, G. Wallis' model of the creative process. http://www.ozemail.com.au/~caveman/Creative/Brain/Wallis.htm

Weinman, J & Haag, P. (1999). Gender equity in Cyberspace. Educational Leadership. Alexandria, VA: ASCD. 56 (5) pp. 44-49.

Wlodkowski, R. (1985). Enhancing Adult Motivation To Learn. San Francisco: Jossey-Bass.